

Probability

Binomial Distribution – Racial Profiling

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Binomial Distribution Review

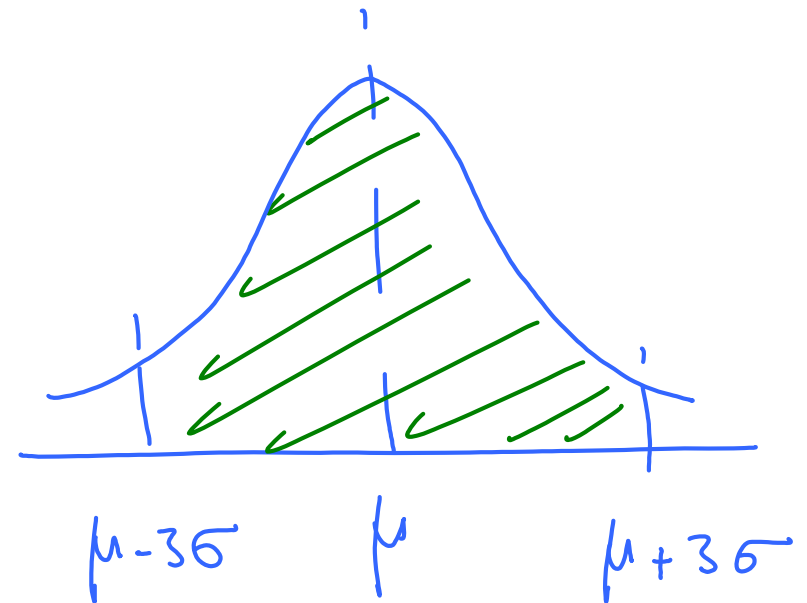
Summary

If $X \sim \text{Bin}(n, p)$, then the mean and variance of X are given by

$$\mu_X = np \quad (4.5)$$

$$\sigma_X^2 = np(1 - p) \quad (4.6)$$

- The **binomial distribution** has a **bell shape** when **n is large**, so in that case, we can **use the normal distribution** to approximate the binomial distribution and conclude that nearly **all the probability** falls between $\mu - 3\sigma$ and $\mu + 3\sigma$



| Checking for Racial Profiling

In 2006, the **New York City Police Department (NYPD)** confronted approximately 500,000 pedestrians for **suspected criminal violations**. Of those confronted, 88.9% were non-white. Meanwhile, according to the 2006 American Community Survey conducted by the U.S. Bureau of the Census, of the more than 8 million individuals living in New York City, 44.6% were white.

- Are the data presented above evidence of racial profiling in police officers' decisions to confront particular individuals?

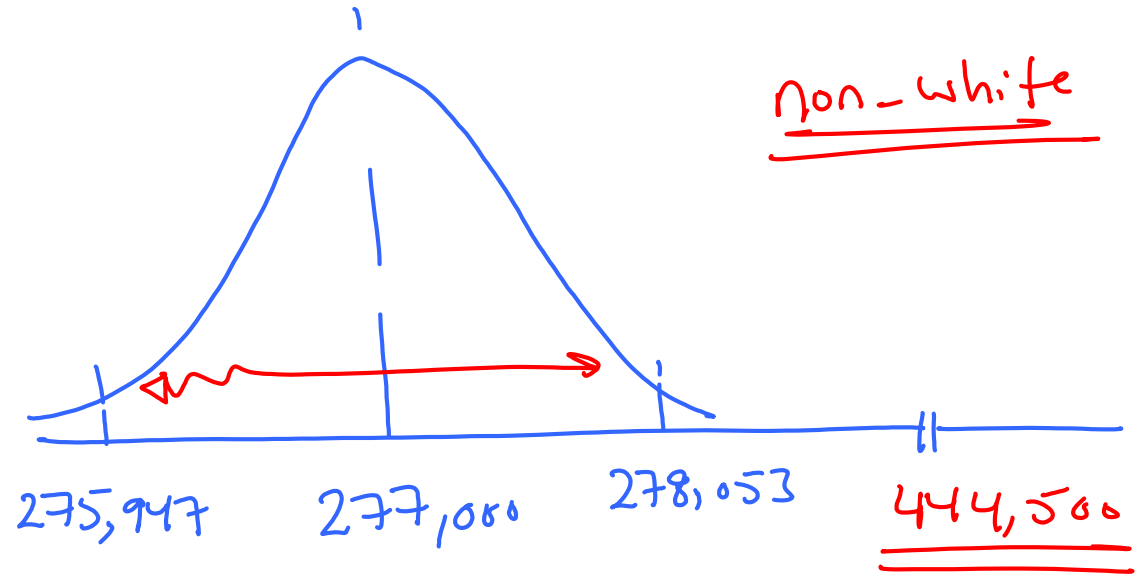
$$n \Rightarrow \# \text{ trials} = 500,000$$

$$p = 0.554 \quad n \rightarrow \text{outcome of interest}$$

$$\begin{aligned} \mu &= np = 500,000 \times 0.554 \\ &= 277,000 \\ \sigma &= \sqrt{np(1-p)} \\ &= \sqrt{500,000 \times 0.554 (0.446)} \\ &= 351 \\ \mu - 3\sigma &= 275,947 \\ \mu + 3\sigma &= 278,053 \end{aligned}$$

$$\mu - 3\sigma = 275,947$$

$$\mu + 3\sigma = 278,053$$



| Checking for Racial Profiling

- The controversial subject of racial profiling continues to receive nation-wide attention.
- A 2013 report by the Bureau of Justice Statistics based on 2011 survey data found that relatively more black drivers (13%) than white (10%) and Hispanic (10%) drivers were pulled over in a traffic stop and that white drivers were both ticketed and searched at lower rates than black and Hispanic drivers.

| References

- Statistics for Engineers and Scientists, Fourth Edition, William Navidi
Colorado School of Mines
- Agresti, A., Franklin, C. and Klingenberg, B., 2017. Statistics: The art and science of learning from data (Fourth Edi).
- Khan Academy